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E46 ALL-WHEEL DRIVE SYSTEM

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E46 ALL-WHEEL DRIVE SYSTEM

Model: E46/16 (330xi/A, 325xi/A, 325xi/A Sport Wagon).

Production date: 330xi 8/00, 325xi 9/00.

Objectives

After completing this module you should be able to:

- Identify the changes made to the E46 to accommodate all-wheel drive.
- Understand the construction of the NV124 transfer case.

Introduction

The E46/16 introduces the return of the BMW all-wheel drive car to the United States. This time all-wheel drive will be an option (SA 203), available on E46 sedans and Sport Wagons beginning 2001M.Y.

Vehicles with the all-wheel drive option have been given the engineering designation of E46/16.

One of the significant changes from the previous E30 ix is that the E46/16 does not use a viscous coupling or limited slip differential. The all-wheel drive system has largely been taken from the X5 concept. It uses two open differentials and a single speed transfer case. Power distribution is 38% to the front and 62% to the rear, giving the E46/16 the feel of a genuine rear-drive road car.

With its additional 17mm ground clearance, the xi is particularly suited to stretches of snow and ice covered roads and its sure footedness is made possible by the use of the Bosch DSC III 5.7 system, first used on the X5.

Performance of the all-wheel drive E46 does not suffer either, this is because of a light-weight all-wheel drive system that only adds 100kg (220lbs). Weight distribution is largely unaffected at 52.7% front and 47.3% rear (2wd: 51.0% front, 49.0% rear).



325xi

Changes from the standard drive version are:

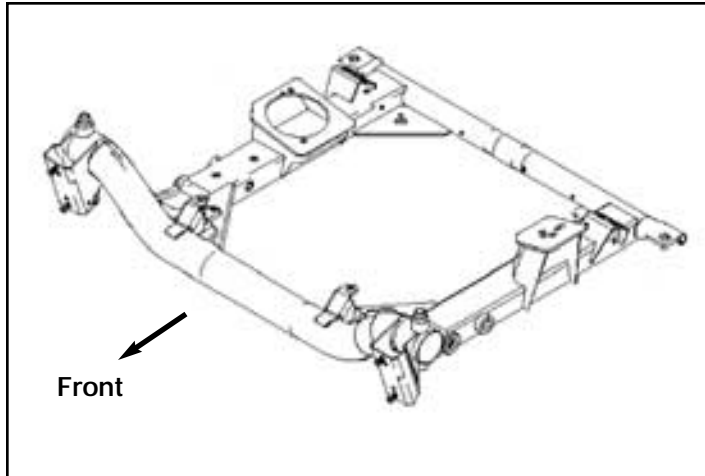
- A specially designed body pan with a widened transmission tunnel and modifications on the driver's side to accept the transfer case.
- Modified oil pan and engine mounts to provide access for the front axles.
- A completely new front engine carrier.
- Re-reinforcements for the front strut bearings.
- A compact new transfer case (NV 124).
- New transmission cross-member.
- Bosch DSC III 5.7



Chassis

Front Axle

The front axle has been completely re-designed over the standard drive E46. All components are constructed of steel.



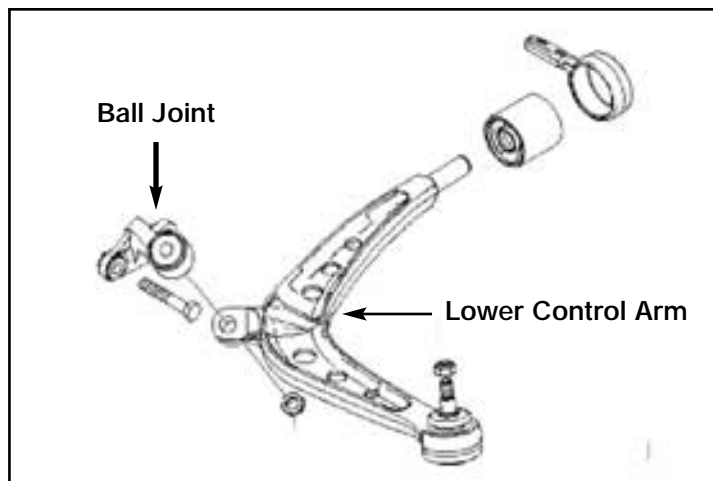
The front axle carrier consists of two square frame sections welded to two tubes to form a box structure. The axle carrier is bolted to the vehicle frame at both the front and rear attachment points.

The steel lower control arms, which are smaller than the aluminum arms used on the 2wd model attach at the rear to the axle carrier.

The pivot at the apex of the lower control arms are a separate ball joint bolted to the axle carrier.

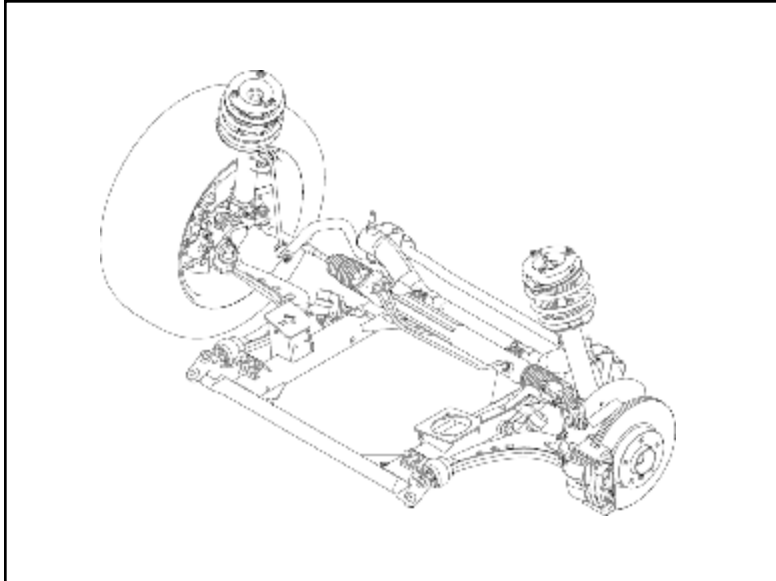
The purpose of the re-design of the lower control arms and mounting points is to provide clearance for the front axle shafts.

The hydraulic engine mounts are different from the 2wd version and have also been relocated to provide front axle clearance.



The front sway bar has been increased in diameter to 23.5mm (2wd standard: 23mm, sports suspension: 24mm) to accommodate the additional weight. A sports suspension option is not available for the xi.

The struts are shorter than the 2wd and there are reinforcement plates between the strut bearing and the sheet metal of the strut towers to prevent deformation when traveling on very poor road surfaces.



The spring travel of the E46/16 is approximately 20mm less than the 2wd version.

The shorter front axle spring travel is due to the limited angle of deflection of the front axle shafts.

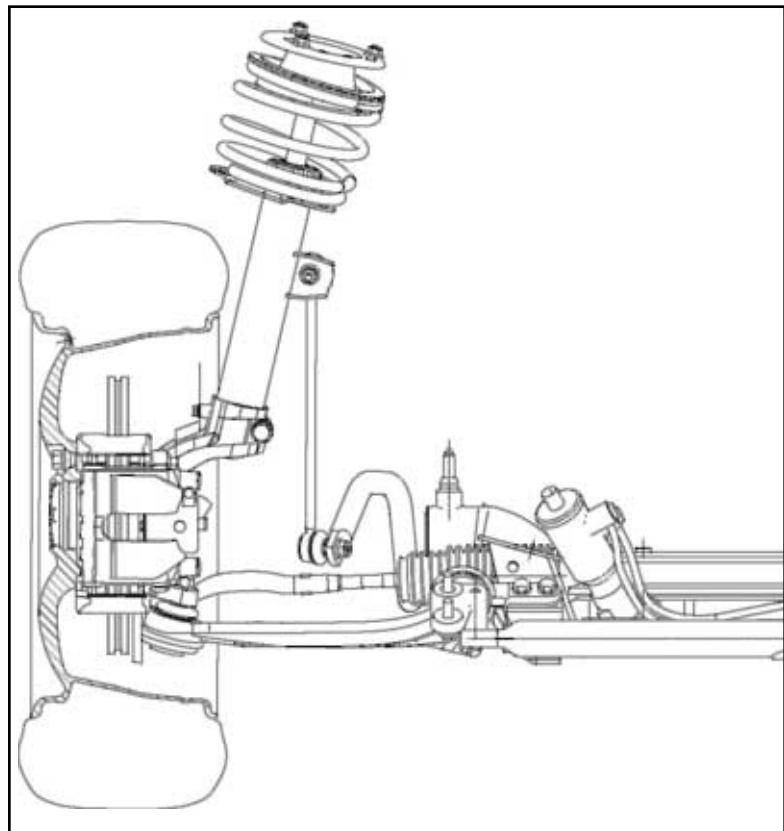
Steering

The rack and pinion steering unit has been modified from the 2wd. It is constructed with a larger diameter piston.

This is necessary to counter the additional drag of the all-wheel drive system and the wider standard wheels and tires.

The lower steering spindle is different than the 2wd and connects to the steering rack via a double cardan joint.

Turning radius of the E46/16 is 35.8ft, 1.4ft greater than the 2wd.

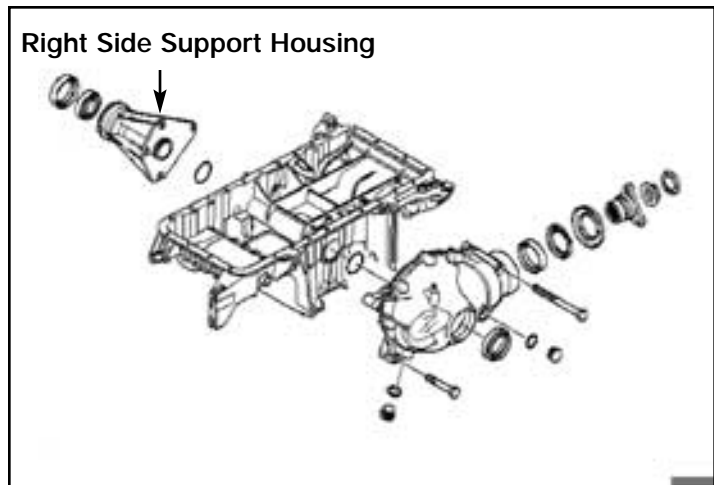


Differential and Front Axles

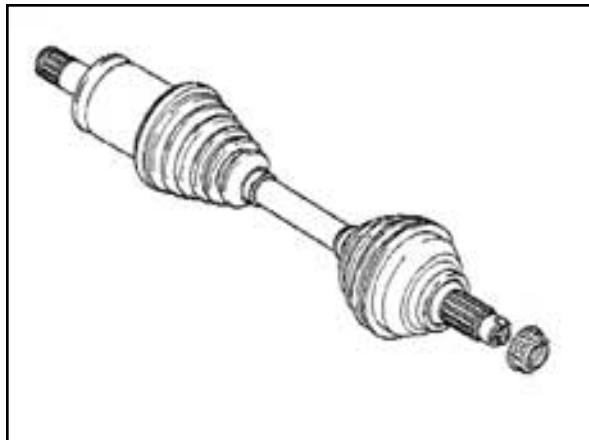
The differential for the front axle is bolted to left side of the engine oil pan. The differential is driven by a 40mm single piece drive shaft. The drive shaft has universal joints at both ends.

Type:	VAG 174	
Axle ratios:	330xi	325xi
Auto:	3,46:1	3,46:1
Man:	3,07:1	3,23:1
Max torque:	2000Nm	
Weight:	40 lbs	

Lifetime fluid fill: SAF-XO

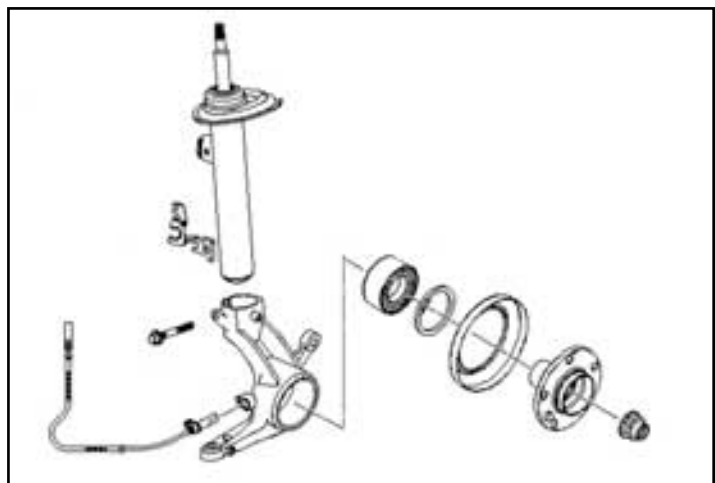


The oil sump has been modified to accommodate the right side axle. A connecting tube is welded into the oil pan. A shaft runs inside of the connecting tube between the front differential and the axle shaft on the right side.



Two drive shafts of equal length are used to transmit power to the front wheels.

The steering knuckle is modified to accept the CV joint of the front axles. The front wheel bearings are unique to the E46/16 and incorporate the wheel speed sensor pulse wheel into the bearing seal.



Rear Axle

The complete rear axle and the rear differential are the same as the 2wd version of the 325i and 330i.

Type:	HAG 188N	
Axle ratios:	330xi	325xi
Auto:	3,46:1	3,46:1
Man:	3,07:1	3,23:1
Max torque:	3000Nm	
Weight:	84 lbs	



Lifetime fluid fill: SAF-XO

The rear spring/strut travel of the E46/16 is approximately 17mm less than the 2wd version. The reason for the reduced travel in the rear is to oppose any excessive body roll as a result of the higher body profile.

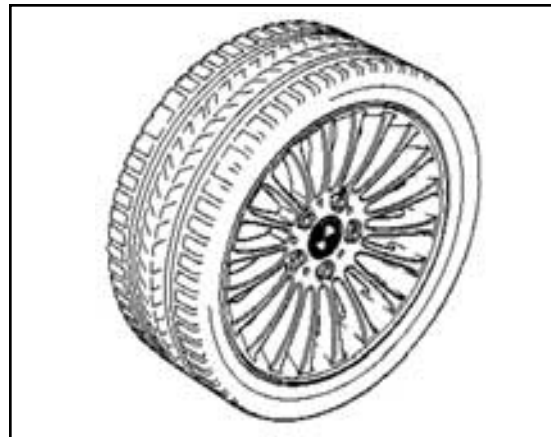
The rear sway bar has been increased in diameter to 20mm (2wd standard: 18mm, sports suspension: 19mm) to accommodate the additional weight.

Tires and wheels

Standard wheel size is 17x 7.0 to ensure there is enough room for the front axles and brakes. Tire size is 205/50 R17 All-season radials



330xi Double Spoke 17x7.0



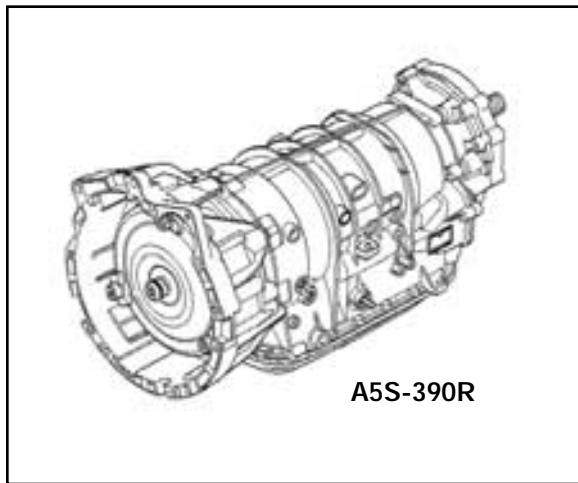
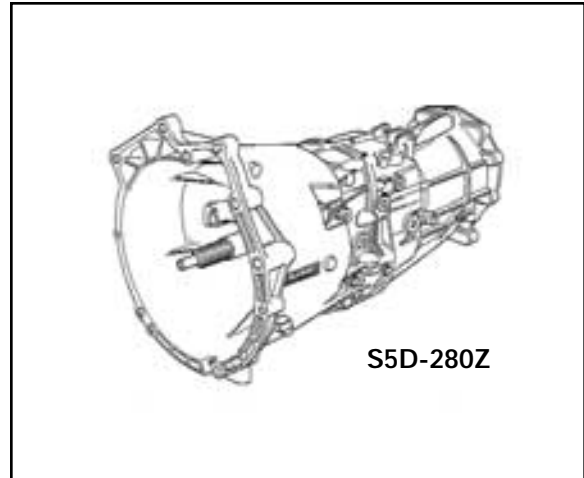
325xi Radial Spoke 17x7.0

Transmissions

There are two transmission variants for the 325xi and 330xi.

The manual transmission for both versions is the S5D-280Z direct gear transmission. The extension housing is modified to accept the transfer case.

The transmission has a lifetime fill of MTF-LT1 synthetic transmission fluid.



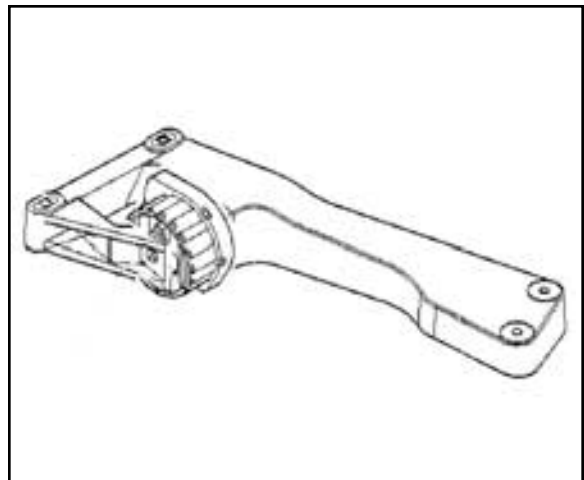
The automatic transmission for both the 330xi and 325xi is the A5S-390 R (General Motors) transmission with GS 20 AGS control and Steptronic shifter.

The transmission has a lifetime fill of Texaco 8072B.

Transmission Cross-member

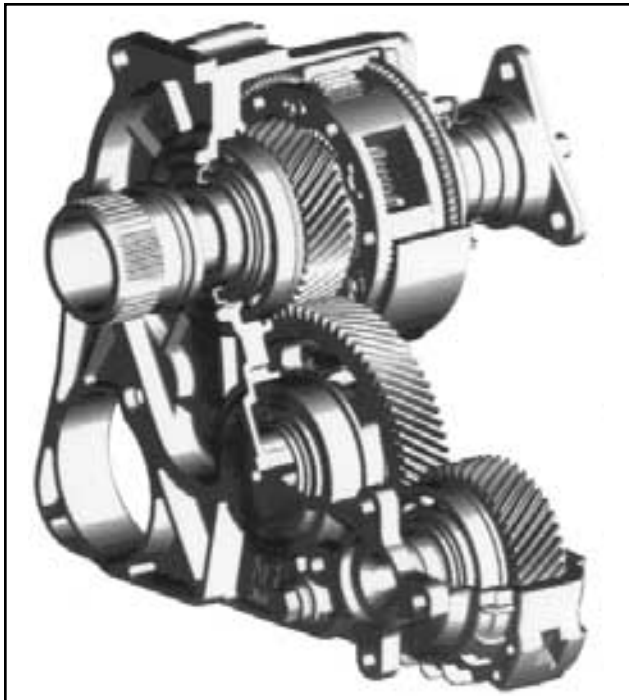
Along with the lower transfer case section, the cast aluminum transmission cross-member is a low profile design to optimize ground clearance.

Both manual and automatic transmissions utilize the same part.



Transfer Case

The Transfer case for the E46/16 is the NV 124 manufactured by New Venture. The primary difference between the NV 124 and the NV 125 used in the X5 SAV is that it uses gears instead of a drive chain for torque transfer to the front axle.



The reason gears are used is to produce a compact low profile transfer case that could fit in the transmission tunnel of an E46 without excessively limiting the forward travel of the drivers seat.

Manufacturer:	New Venture
Type:	NV 124
Torque Distribution:	38%: 62%
Maximum Torque:	300Nm

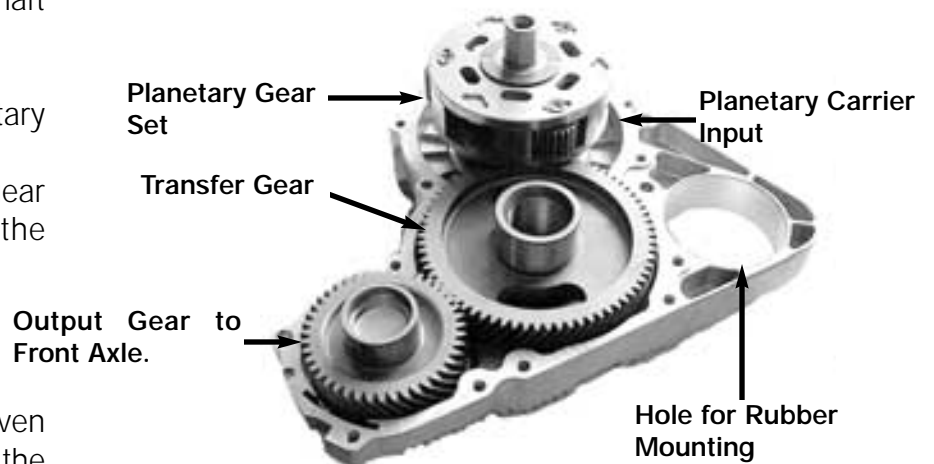
The transfer case is only one speed and does not use any viscous coupler.

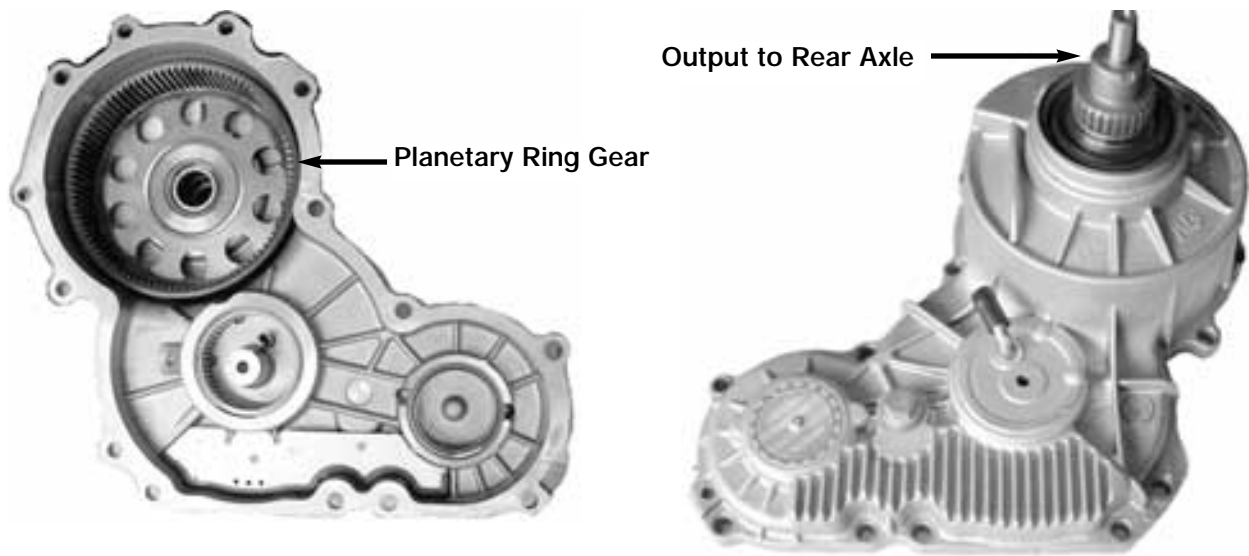
The transmission ratio of the planetary gear set provides a fixed torque transfer of 38:62 (front:Rear). The output speeds to the front and rear axle are the same (1:1).

The input to the Planetary Carrier is from the output shaft of the transmission.

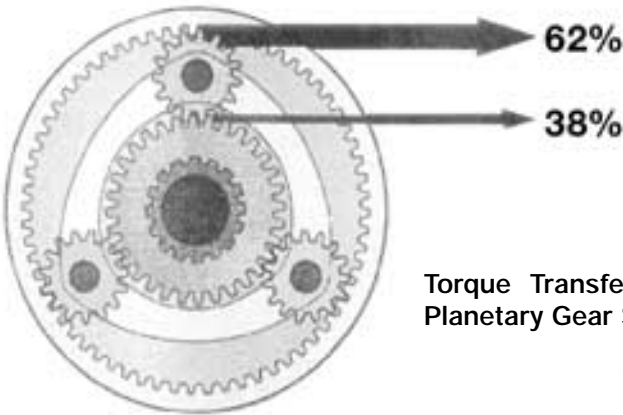
The Sun Gear of the Planetary assembly is turned by the Planetary Gears, the Sun gear then provides torque to the Transfer Gear.

The Transfer Gear drives the Output via gear-to-gear contact. The front axle is driven via a flange connected to the output gear.





From the Ring Gear , the power is transmitted via the driveshaft to the rear axle differential.



Torque Transfer from the Planetary Gear Set.

The transfer case is filled with a lifetime fill of MTF-LT1 P/N 83-22-9-408-942. The only repairs possible are the replacement of the three oil seals and the hydraulic mount.

Oil Volume: 0.24 liter
 Drain/Fill plug torque: 33Nm

